

Formula Student Netherlands			
2025 Inspection Sheet			
Electrical Inspection			
Car Number			
University			
	Failed items	Comments	
ESF			
Progress	0.00%		
	REQUIRED RESOURCES		
No.	Checkpoint	Checkbox	Comment
	- An ESO must attend		
	- LV battery or cell datasheet		
	- Samples of all wire types used for the tractive system		
	- Photographs of all inaccessible TS connections		
	- Fully assembled spare boards of all inaccessible TS boards		
	- For self developed LV battery packs: an opened battery pack, laptop and cables to display data of the AMS		
	- Laptop and cables to display data of the AMS		
	- Power Supply for TSAL test and connectors with shrouded banana jacks as in rule IN 4.2.1		
	- The connector to safely close the SDC while the HVD is removed		
	- Datasheets for used wiring, insulation materials, and TS components NOT ON A CELL PHONE		
	- Print-outs of Rule Requests, if applicable NOT ON A CELL PHONE		
	- At least all non-passed parts of the ESF NOT ON A CELL PHONE		
	- "TSAL green" sign		
	TS VOLTAGE		
No.	Checkpoint	Checkbox	Comment
	► Measure voltage at TS measuring points		
	1 Equal or less than 60 VDC	☐	
	LV BATTERY		
No.	Checkpoint	Checkbox	Comment
	2 Voltage $\leq$ 60VDC	☐	
	3 Rigid and sturdy casing	☐	
	4 Short circuit protection (e.g. fused)	☐	
	5 Behind Firewall	☐	
	6 Proper insulation of internal electrical connections	☐	
	7 Proper mounting of cells	☐	
	8 Complete battery pack inside rollover protection envelope	☐	
	► All following checks only needed for Li-Ion batteries (other than LiFePO4):		
	9 UL94-V0 , FAR25 or equivalent casing	☐	
	10 Overtemperature protection of at least 30% of the cells (max. 60 C or datasheet, whichever is lower)	☐	
	SELF DEVELOPED PCBS		
No.	Checkpoint	Checkbox	Comment
	► Ask for spare PCB of self developed PCBs		
	11 Sufficient spacing regarding system voltage and implementation	☐	
	12 Sufficient rating of isolators regarding system voltage, check datasheets	☐	
	13 Sufficient insulation and temperature rating of coating if used, check datasheet	☐	
	14 Coating process according to datasheet	☐	
	15 The 1 min AC RMS isolation test voltage is $\geq$ 3x max. TS voltage	☐	
	16 The working voltage of the isolation barrier, if specified in the datasheet, is higher than the maximum TS voltage	☐	
	17 BSPD PCB is standalone with only minimum interface	☐	
	18 BSPD PCB(s) are directly supplied from the LVMS	☐	
	MASTER SWITCHES		
No.	Checkpoint	Checkbox	Comment
	19 TSMS & LVMS installed on the right side of the vehicle and located next to each other	☐	
	20 TSMS & LVMS are easily accessible	☐	
	○ All master switches are located above 80% of shoulder height of percy		
	21 Rigidly mounted	☐	
	22 Not mounted on removable bodywork	☐	
	23 Rotary type with removable handle	☐	
	○ Handle length $\geq$ 50 mm		

	24	ON position in horizontal	☐	
	25	"ON" and "OFF" positions marked	☐	
	26	TSMS with locking mechanism for "OFF" position	☐	
	27	LVMS marked with "LV" and symbol showing a red spark in a white edged blue triangle	☐	
	28	LVMS mounted on an red circular area on high contrast background	☐	
	○	Circular area diameter ≥50 mm		
	29	TSMS marked with "TS" and triangle with black lightning bolt on yellow background	☐	
	30	TSMS mounted on an orange circular area on high contrast background	☐	
	○	Circular area diameter ≥50 mm		
MEASURING POINTS				
No.	Checkpoint		Checkbox	Comment
	31	Two TS voltage measuring points on orange background	☐	
	32	A black LV ground measuring point installed	☐	
	33	Next to the master switches	☐	
	34	4mm shrouded banana jacks	☐	
	35	Non conductive cover	☐	
	36	Cover removable without tools	☐	
	37	Correctly marked (TS+, TS-, GND)	☐	
TS SHUTDOWN DEVICES				
No.	Checkpoint		Checkbox	Comment
	38	Two red latching shutdown buttons installed next to the main hoop	☐	
	39	Right and left on the vehicle at approx. height of drivers head	☐	
	40	Push-Pull or Push-Rotate-Pull functionality	☐	
	○	Diameter > 39 mm		
	41	Marked with red sparked sticker	☐	
	42	One cockpit shutdown button installed	☐	
	43	Push-Pull or Push-Rotate-Pull functionality	☐	
	44	Marked with red sparked sticker	☐	
	45	Easy actuation by the driver	☐	
	○	Diameter ≥24 mm		
	46	All shutdown buttons are red in colour	☐	
	47	Inertia switch rigidly mounted upright to the chassis and can be demounted for functionality test	☐	
HIGH VOLTAGE DISCONNECT				
No.	Checkpoint		Checkbox	Comment
	48	Clearly marked with "HVD"	☐	
	○	Distance to ground greater than 350 mm		
	49	Unobstructed and directly accessible	☐	
	50	No remote actuation (e.g. through wires)	☐	
	51	Integrated interlock	☐	
	►	Stand next to the vehicle. Let ESO remove HVD		
	52	Removed within 10s without tools	☐	
	53	TS protection still given (insulated test probe)	☐	
	54	If a dummy connector for protection is used, it must be stored at the push bar	☐	
ACCELERATION PEDAL POSITION SENSOR (APPS)				
No.	Checkpoint		Checkbox	Comment
	55	Returns to original position if not actuated	☐	
	56	At least two sensors with different, non-intersecting transfer functions, with either different gradients and/or offsets to the other(s) are installed. (For digital sensors, a checksum is necessary)	☐	
	57	Sensors are protected from being mechanically over-stressed (positive stop of pedal)	☐	
	58	Minimum two springs installed to return pedal	☐	
	59	Each spring still returns pedal with the second one disconnected (springs in the torque encoders not counted)	☐	
ACCUMULATOR MANAGEMENT SYSTEM				
No.	Checkpoint		Checkbox	Comment
	►	Install TS accumulator, activate LVS, and connect laptop to the AMS		
	60	AMS data can be displayed	☐	
	61	If Li-Ion LV battery: LV battery's AMS data can be displayed	☐	
	►	Disconnect TS accumulator, if applicable		
	►	AMS indicator light . . .		
	62	. . . is illuminated red	☐	
	63	. . . is inside the cockpit and marked with "AMS"	☐	
	64	. . . is visible in bright sunlight, even from outside	☐	
	65	. . . is visible for the driver	☐	
BRAKE LIGHT				
No.	Checkpoint		Checkbox	Comment
	66	Only one brake light in red color	☐	

	67	Clearly visible from behind the vehicle	☐	
	68	Located on vehicle centerline	☐	
	69	Height between wheel centerline and drivers shoulder	☐	
	70	Round, triangle, or rectangular on black background	☐	
	⊙	15 cm² minimum illuminated area OR LED strips with a total length greater than 150mm with elements closer than 20 mm apart		
	71	Sufficient brightness of the brake light even in bright sunlight	☐	
TS WIRING				
No.		Checkpoint	Checkbox	Comment
	72	All TS wiring and components (including the HVD) have to be in the rollover protection envelope and behind the impact structures	☐	
	73	All TS wires and connectors have proper overcurrent protection	☐	
	74	TS wiring channels are orange	☐	
	75	No other wires than TS wires are orange	☐	
	76	TS wiring outside electrical enclosures in separate non-conductive enclosure or orange shielded cable	☐	
	77	Securely anchored to withstand at least 200N if outside of enclosure	☐	
	78	Located out of the way of possible snagging or damage	☐	
	79	Shielded against rotating/moving parts	☐	
	80	No wire lower than the chassis	☐	
	81	TS and LV wires separated (n/a for interlock)	☐	
	82	Marked with gauge, temperature rating and voltage rating (max. TS voltage)	☐	
	83	Suitable temperature rating of at least 85 degrees	☐	
	84	Positive locking mechanism on every screwed connection according to T10.2 and EV4.5.13 (Photographs for all inaccessible TS connections)	☐	
	85	TSMs: positive locking mechanism on banana jack according to EV4.7.7 for TSMP	☐	
	86	Insulation is not insulating tape or rubber-like paint	☐	
	87	The wiring outside of the impact structure is the shortest possible distance	☐	
	88	TS wires of outboard wheel motors must not be able to reach the cockpit opening in case of a wire break	☐	
	▶	Check interlocks on . . .	☐	
	90	. . . TS accumulator container(s)	☐	
	91	. . . Inverters	☐	
	92	. . . Power distribution boxes	☐	
	93	. . . Data logger enclosure	☐	
	94	. . . Outboard wheel motors have a dedicated interlock wire routed along the TS wiring, must act before the TS wiring or its clamping fails	☐	
	95	. . . Outboard wheel motors have a dedicated interlock wire routed along a suspension member, must act if the suspension fails	☐	
	96	Interlocks can be opened for demonstration	☐	
TRACTIVE SYSTEM PROTECTION				
No.		Checkpoint	Checkbox	Comment
	▶	Check for each TS enclosure . . .		
	97	. . . Not possible to reach any TS potentials with insulated test probe (100 mm length, 6 mm diameter)	☐	
	98	. . . Protected from moisture	☐	
	99	. . . HV warning stickers placed (triangle with a black lightning bolt on yellow background)	☐	
	100	Energy meter is fully enclosed in a housing and not in the accumulator	☐	
	101	Energy meter is rigidly mounted	☐	
	⊙	Check energy meter functionality and connectivity		
	102	Seal energy meter enclosure(s)	☐	
GROUNDING CHECKS				
No.		Checkpoint	Checkbox	
	•	A conductive part is grounded when having ≤100 mΩ measured at 1 A to LVS ground and being able to continuously carry ≥10 % of the TS main fuse		
	•	It is possible to join two TS enclosures, one following EV 3.1.1 point 1 and the other one following point 2, if each individual is fully closed		
	▶	Check for each TS enclosure . . .		
	103	. . . all materials used to build a TS enclosure separately have a resistance ≥2MΩ@500 V ⇒ fully isolated TS enclose, no grounded layer needed	☐	
	104	. . . expect e.g. screws, (shielded) connectors, backing plates isolating materials used ⇒ fully isolated TS enclose, no grounded layer needed but protruding elements must be properly grounded	☐	
	105	. . . at least one material has <2MΩ ⇒ ≥0.5 mm thick solid grounded layer made of aluminium or better (TSAC: ≥0.9 mm thick steel layer) required and properly grounded	☐	
	▶	Measure resistance of conductive parts to LVS ground (max. 100 mΩ@1 A) . . .		
	▶	Use second LVS ground measurement point for 4-wire connection if available		
	106	. . . main hoop	☐	
	107	. . . seat mounting points	☐	
	108	. . . driver harness mounting points	☐	
	109	. . . firewall mounting points	☐	
	110	. . . TS firewall	☐	

111	. . . TS accumulator container	☐	
112	. . . TS motors	☐	
113	. . . TS enclosures if applicable	☐	
114	. . . TS enclosure protruding parts if applicable	☐	
115	Each grounding is able to carry ≥ 10 % of TS main fuse	☐	
	○ Measure resistance of conductive parts to LVS ground (max. 100 Ω @ 0 A) . . .		
	○ . . . carbon fiber part within 10 cm around TS part		
	○ . . . suspension front left or right if applicable		
	○ . . . suspension rear left or right if applicable		
DISCHARGE CIRCUIT AND BODY PROTECTION RESISTORS			
No.	Checkpoint	Checkbox	Comment
	► Measure resistance between TS+ and TS- Measuring Points		
116	Resistance is 30 k Ω + discharge resistor	☐	
117	Body protection resistor power and voltage rating is sufficient	☐	
118	Dis-charge power rating is sufficient for continuous dis-charge	☐	
119	Resistor Derating was considered for Power Rating	☐	
INSULATION MEASUREMENT TEST			
No.	Checkpoint	Checkbox	Comment
	► Choose test voltage to 500V		
	► Connect insulation tester to TS+ and LV ground		
	► Measure resistance: Riso+ = M Ω		
120	Resistance is much higher than (min. 500 Ω /V*Umax)	☐	
	► Connect insulation tester to TS- and LVMP		
	► Measure resistance: Riso- = M Ω		
121	Resistance is much higher than (min. 500 Ω /V*Umax)	☐	
122	Resistances are nearly equal	☐	
123	IMD chassis ground measurement line from TSAC connected to the main hoop by a separate wire	☐	
TEST AT HIGH VOLTAGE			
TRACTIVE SYSTEM POWER UP			
No.	Checkpoint	Checkbox	Comment
	► All driven wheels are off the ground, driven wheels removed		
	► Connect multimeter between TS+ and TS- Use the team's multimeter and test leads from the push bar. Set multimeter into manual range		
	► Switch on TSMS with LVMS deactivated		
124	Voltage at TS measurement points less or equal 60VDC	☐	
	► Switch on LVMS with TSMS deactivated		
125	IMD and AMS indicator light illuminate for 1 to 3 s for visible check	☐	
126	Voltage at TS measurement points less or equal 60VDC	☐	
	► Switch on TSMS and all shutdown buttons		
	► Reset any IMD or AMS errors if possible, otherwise reset LVS		
127	TS still deactivated	☐	
	► Activate TS, measure TS voltage during TS power-up		
128	System is precharged before second AIR closes	☐	
	► Switch off TSMS		
129	TS voltage decreases below 60VDC within 5 s	☐	
	► Try to power-up TS with switched off TSMS		
130	TS still deactivated	☐	
	► Switch on TSMS		
131	TS still deactivated	☐	
TRACTIVE SYSTEM SHUTDOWN			
No.	Checkpoint	Checkbox	Comment
	► Connect multimeter between TS+ and TS-		
	► Check first and two more of the following switches, deactivation leads to TS shutdown, voltage decreases below 60VDC within 5s		
132	LVMS	☐	
133	Cockpit shutdown button	☐	
134	Shutdown button left	☐	
135	Shutdown button right	☐	
136	Inertia switch (may be demounted for test)	☐	
137	Brake-over-travel switch	☐	
	► Check at least two TS Interlocks.		
138	Interlocks	☐	
TRACTIVE SYSTEM ACTIVE LIGHT			
No.	Checkpoint	Checkbox	Comment
139	Max. 75 mm below the highest point of the main hoop and within the roll-over protection envelope (including mounting)	☐	
140	Full illuminated surface visible by a person standing 3 m away from TSAL (1.6 m eye height)	☐	

141	≤10° blocked by main hoop	☐	
	▶ Activate LV system		
142	TSAL and Cockpit Indicator(CI) are green only	☐	
	● TS off indicator light . . .		
	. . . is inside the cockpit and marked with "TS off"	☐	
	. . . is visible in bright sunlight	☐	
	. . . is visible for the driver	☐	
	▶ Activate TS		
146	TSAL flashes red with freq 2 Hz - 5 Hz and CI is off	☐	
147	TSAL is clearly visible (horizontal position, entire illuminated surface)	☐	
148	Voltage indicator shows presence of > 60 VDC	☐	
	▶ Deactivate TS, disconnect AIR state detection circuitry, activate LV If activation of LV system is not possible skip test		
149	TSAL not illuminated and CI is off	☐	
	▶ Deactivate TS, reconnect TSAC state detection, connect power supply >60 VDC to TS via dedicated connector but NOT TSMP, activate LVS		
150	TSAL is both green and red flashing simultaneously and CI is on	☐	
	▶ Disconnect power supply, remove HVD, override HVD interlock (!! cover HV potentials !!), activate LV and TS		
151	TSAL and CI is off	☐	
INSULATION MONITORING DEVICE			
No.	Checkpoint	Checkbox	Comment
	▶ Determine Rtest = (max TS voltage * 250 Ω/V) - BPR		
	▶ Activate TS, connect RTest between TS+ and LV GND		
152	Shutdown circuits opens within 30s	☐	
153	Only IMD indicator light illuminates	☐	
154	TS voltage decreases below 60VDC within 5s after shutdown circuit opens	☐	
	● IMD indicator light . . .		
	. . . is illuminated red	☐	
	. . . is inside the cockpit and marked with "IMD"	☐	
	. . . is visible in bright sunlight, even from outside	☐	
	. . . is visible for the driver	☐	
	▶ Try to activate the TS by the required additional action (EV 4.11.4)		
159	Reactivation of TS is not possible	☐	
	▶ Push the reset button which is not accessible to the driver, if any		
160	Reactivation of TS is not possible	☐	
	▶ Remove RTest. Wait 40s until IMD resets status output		
161	Reactivation of TS is not possible	☐	
	▶ Push all reset buttons in the cockpit, if any		
162	Reactivation of TS is not possible	☐	
	▶ Push the IMD reset button which is not accessible to the driver, if any		
163	Reactivation of TS is possible	☐	
	▶ Reset vehicle and activate TS. Push and hold the reset button which is not accessible to the driver, if any. Connect RTest between TS+ and LV GND		
164	Shutdown circuits opens within 30s	☐	
165	IMD indicator light illuminates	☐	
	▶ Activate TS, connect RTest between TS- and LV GND		
166	Shutdown circuits opens within 30s	☐	
READY TO DRIVE ACTIVATION SEQUENCE			
No.	Checkpoint	Checkbox	Comment
	▶ Activate TS, press torque pedal		
167	No turning of motors	☐	
	▶ Let the team set the vehicle to ready to drive mode		
168	Pressing brake pedal WHILE activating is necessary	☐	
169	Ready to drive sound duration is 1 s to 3 s	☐	
170	Ready to drive sound is min 80 dBA (2m around the vehicle)	☐	
171	Ready to drive sound is easy recognizable and no animal sound or song part	☐	
	▶ Repeat the activation sequence, but push the brake pedal only once before finally pushing the activation button		
172	No ready to drive mode possible	☐	
	▶ Disconnect the brake sensor		
173	No ready to drive mode possible	☐	
	▶ Disconnect the second brake sensor if applicable		
174	No ready to drive mode possible	☐	
APPS AND BSPD			
No.	Checkpoint	Checkbox	Comment
	▶ Set vehicle in ready to drive state		
175	Motors are able to turn	☐	
	▶ Disconnect ≥50% of APPS		

176	Motors do not turn	☐	
	▶ Disconnect all APPS		
177	Motors do not turn	☐	
	▶ Reconnect all APPS, disconnect any communication connection between ECU and inverter while motors turn. !! Only with enabled Speed Limit !!		
178	Motors stop turning	☐	
	▶ Disconnect Brake Pressure sensor		
179	Motors stop turning	☐	
	▶ Team simulates 5kW power, press brake representing hard braking (>0.5 s)		
180	TS shuts down	☐	
	▶ Reactivate TS, disconnect BSPD current sensor		
181	TS shuts down	☐	
	▶ Automatic BSPD reset installed?		
182	Reactivation of TS is only possible after 10s without implausibility	☐	
183	Wire ends of auxiliary winding for current simulation are insulated (no tape)	☐	
OTHER COMMENTS			
APPROVAL STATUS			
	Approval (Control box) (DON'T CHANGE MANUALLY)	FALSE	
	Num True	0	
	Num False	183	